

The Use of Rhythmical Stimuli to Improve Gait and Quality of Life in Patients with Parkinson's Disease.

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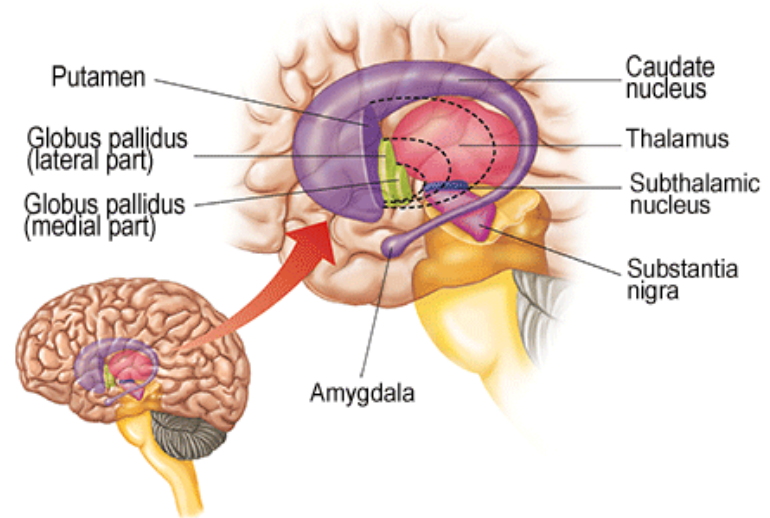
The Problem

- Impairs motor control
- Safety and quality of life are affected (Pickering et al, 2007)
- Parkinson's disease is becoming more common, 1/3000 (Dorsey et al, 2007)
- Decreased Productivity
- Costs society 23 billion dollars each year
 - increased care costs
 - decreased productivity (Huse et al, 2005)

Parkinson's disease

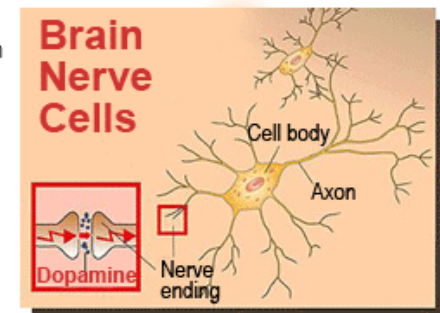
- How does Parkinson's disease occur?
- No known cause?
- dopaminergic cells
 - Decrease in dopamine released
 - substantia nigra of the basal ganglia

The Human Basal Ganglia



Near the base of the brain is a small area called the substantia nigra which contains cells that produce dopamine.

Dopamine acts as a transmitter between the nerve endings.



* O'Sullivan and Schmidt, 2001

Symptoms

- Bradykinesia, Akinesia, Rigidity, Tremors
- Gait and mobility impairments
- Impaired postural reflexes/ balance
- Quality of Life

* O'Sullivan and Schmidt, 2001

Relevance to Physical Therapy

- Physical therapy is a common treatment to complement the use medication (Morris, 2000)
- No one intervention has been found to be effective (Gage and Storey, 2004)

Using Rhythm



- How can rhythmical and repetitive stimuli and movements be useful? (Edworthy and Waring, 2006; Thaut et al, 1999; Brown, 2003)
- How could it be used in the Physical Therapy Practice:
 - Improved patient's gait deficits
 - Improved subjects balance
 - Increase reach



Primary Question

- Will the use of repetitive, rhythmical stimuli and movement to music promote an improvement in gait mechanics and improve the patient's quality of life?
 - P=Patients with Parkinson's disease
 - I= Repetitive, Rhythmical cues and movement to music
 - C=Comparing use of repetitive and rhythmical training to other forms of therapy
 - O= Improved gait mechanics, balance and increased Quality of Life
- This is a foreground (intervention) question

Hypothesis

- Null: The use of repetitive, rhythmical stimuli and movement to music will have no effect on the patient's gait or quality of life
- Alternate: The use of repetitive, rhythmical stimuli and movement to music will improve the patient's gait and quality of life

Expected findings

- Compared to just Physical Therapy, patients will achieve improved gait mechanics and quality of life.



Theoretical Rationale

- Tap into the basal ganglia with the use of music
- Rats exposed to music (Sutoo and Akiyama, 2004)
 - 18% increase in dopamine in the neostriatum
- Rats exposed to repetitive motion stimuli (Herman et al, 2007)
 - Improved gait mechanics
- Humans moving legs rhythmically (Brown et, 2006)
 - PET scans show increase in activity in basal ganglia and Putamen

Purpose

- document the existing evidence of the effects of repetitive, rhythmical stimuli and movement to music on gait mechanics and the quality of life for patients with Parkinson's disease



Search Methods: Key words

- Parkinson's (Disease)
- Parkinsonism
- Repetitive
- Rhythmical
- Music (therapy)
- Metronome
- Dance (therapy)
- Physical therapy
- Physiotherapy
- Quality of life



Methods: Inclusion Criteria

- The subjects are >45 years in the study.
- Parkinson's patients in Hoehn and Yahr stages I to IV.
- Rhythmic stimuli and/or rhythmic movement stimulation as their primary experimental intervention
- Experimental group and a comparison group or time.
- The outcome measures must include one or more of the following; gait speed, cadence, stride length, United Parkinson's disease rating scale- motor score (UPDRS-MS), BBS or a quality of life score such as the PDQL.
- Studies must be written in English

Search Methods: Sources

- Databases: Medline/Pub med, PEDro and Cochrane Database
- Level of Evidence: studies included:
 - level II and III (small randomized control studies and case controlled studies)
- Time frame: 1996 to the present

Study findings

- Total number of studies identified: 35
- Number of studies appropriate for secondary questions: 20
- Number of studies found with key words: 15
- Number of studies that met all criteria to answer primary question: 11

(an independent reviewer verified that these 11 studies met all criteria)

Description of Studies

Author	Study Type	Descriptions	Level of evidence
Hackney et al, 2007	Randomized Controlled, single blinded tests	Tango versus exercise effects mobility and balance	2b
Pacchetti et al, 2000		Music Therapy compared to Physical Therapy effects mobility and quality of life	2b
Thaut et al, 1996		regular use of RAS when walking to with and without RAS and no treatment in terms of gait mechanics	2b
Del Olmo et al , 2006	Pre-test/ Post Test Case-Controlled study	regular activities involving repetitive, rhythmical movements improve temporal variability in gait and finger tapping.	3a

Description of Studies

Author	Study Type	Description	Level of evidence
Freedland et al, 2002	Pre-test / Post-Test Case-Controlled study	RAS on gait mechanics of Parkinson's patients	3a
Hausdorff et al, 2007			3a
McIntosh et al, 1997			3a

Description of Studies

Author	Study Type	Description	Level of evidence
Rochester et al, 2005	Pre-test/ Post Test Case- Controlled study	rhythmical cues on functional tasks in the home environment	3a
Suteerawattananon et al, 2003		RAS on the gait mechanics	3a
van Wegan et al, 2005		rhythmical optic cues on the gait mechanics	3a
van Wegan et al, 2006		rhythmical somatosensory cues on gait mechanics	3a

Statistics

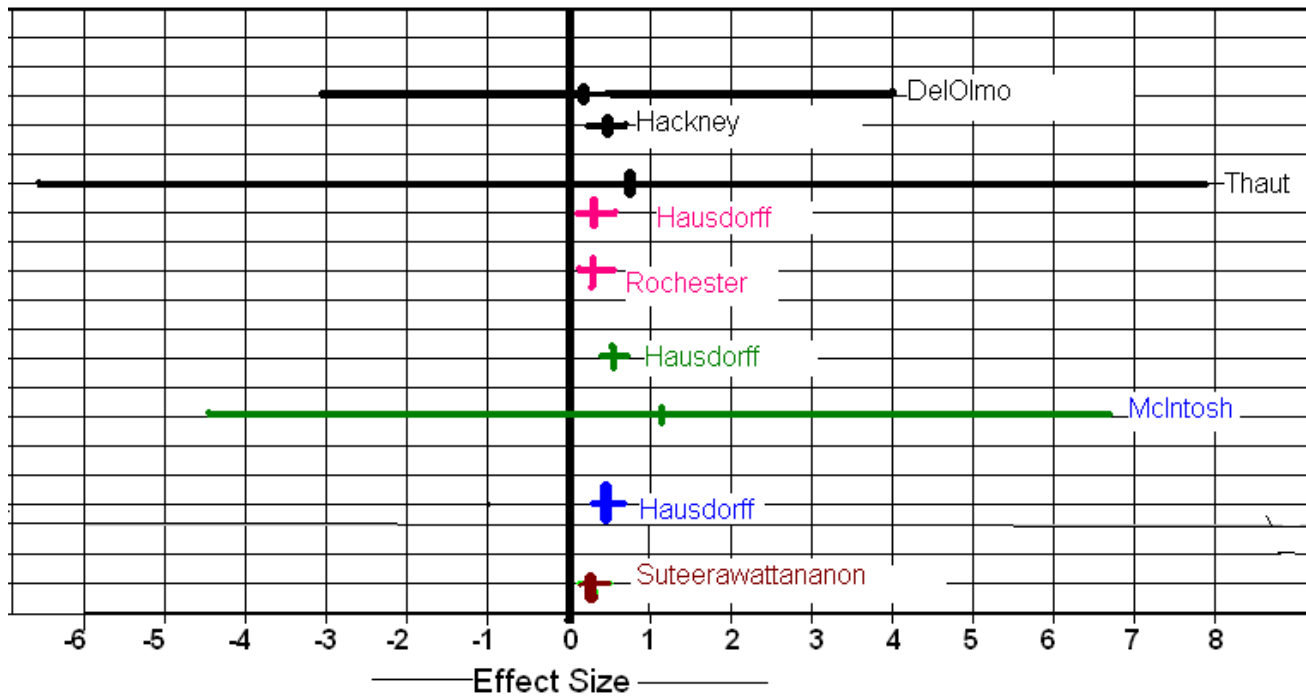
- The Number Needed to Treat (NNT)
 - $NNT = 1 / EER - CER$
- The Effect Size (ES)
 - $ES = \frac{(PRE - POST)}{\sqrt{[(SD^2) + (SD^2)] / 2}}$

Results: Gait Speed Effect Sizes

Author	Post RAS	RAS+ 10%	RAS +25%	post RAS +10%	s/p 15 minutes	post multi day tx
Hausdorff et al 2007	0.376	0.39	X	0.599	0.536	X
McIntosh et al. 1997	X	X	X	1.16	X	X
Rochester et al, 2005	0.333	X	X	X	X	X
Del Olmo et al , 2006	X	X	X	x	x	0.173
Hackney et al, 2007	X	X	X	x	x	0.5
Thaut et al, 1996	X	X	X	x	x	0.732
Suteerawattananon et al, 2003	X	X	0.37	X	X	X

Results: Gait Speed

Effect Sizes of Gait Speed with 95% Confidence Intervals



Types of Therapy

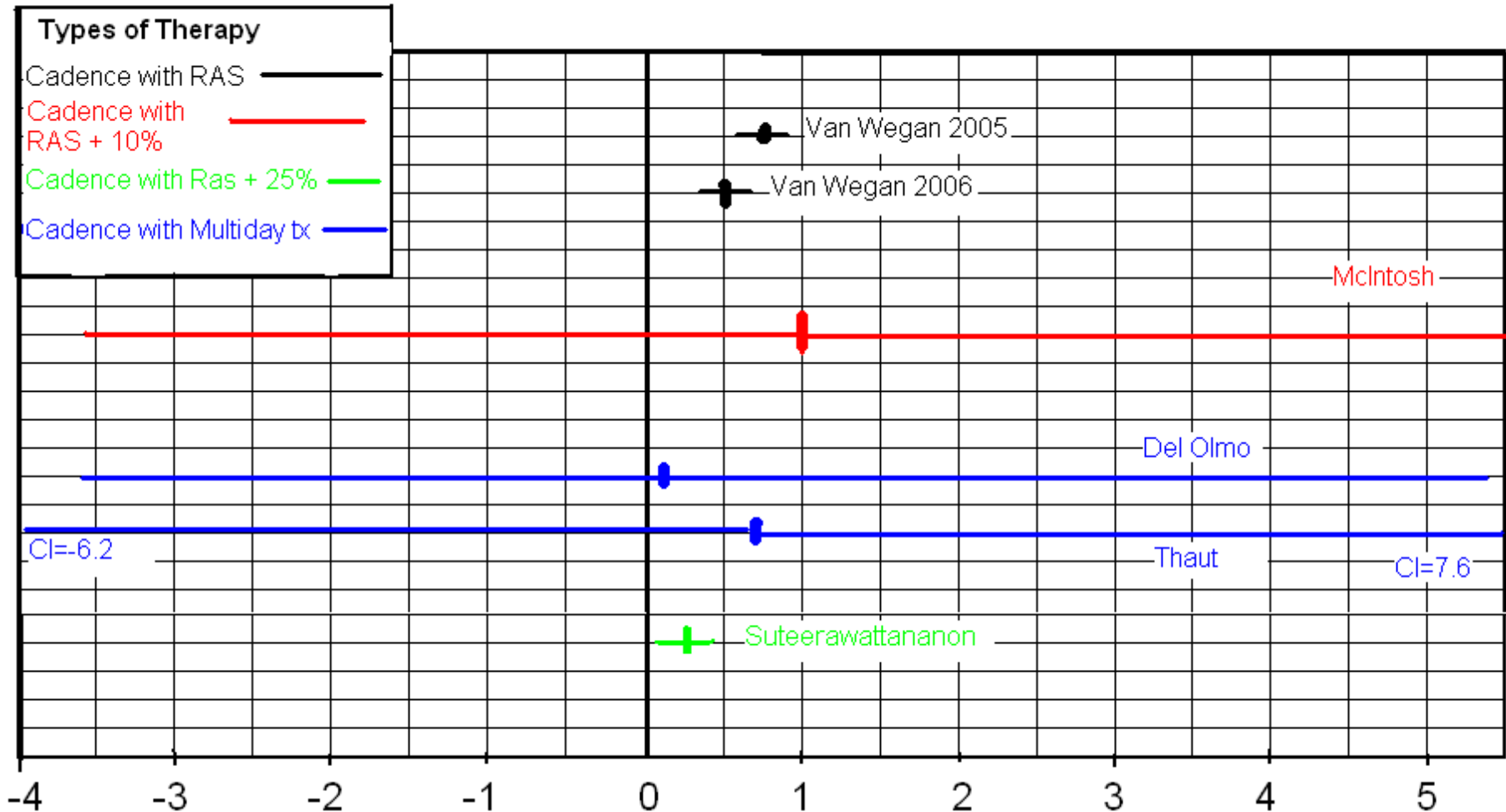


Results: Cadence Effect Sizes

Author	RS	RAS + 10%	RAS + 25%	post RAS	post RAS + 10%
McIntosh et al, 1997	X	1	X	X	0.9
van Wegan et al, 2005	0.769	X	X	X	X
van Wegan et al, 2006	0.552	X	X	X	X
Del Olmo et al , 2006	X	X	X	0.183	X
Thaut et al, 1996	X	X	X	0.71	X
Suteerawattananon et al, 2003	X	X	0.24	X	X

Results: Cadence

Effect Sizes of Cadence with 95% Confidence Intervals

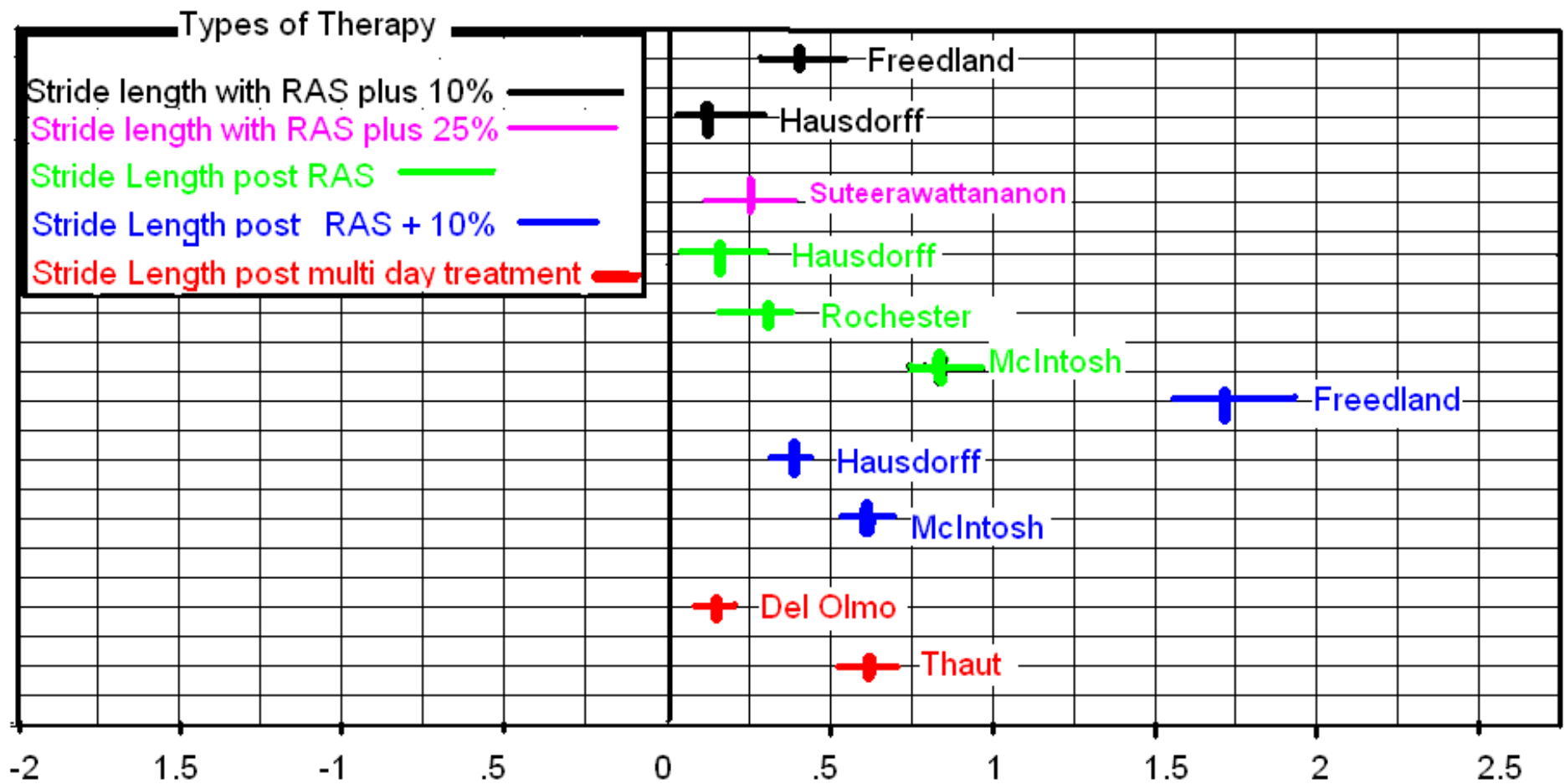


Results: Stride Length Effect Sizes

Authors	RAS+ 10%	RAS + 25%	post RAS	post RAS +10%	post tx
Freedland et al, 2002	0.4	X	X	1.72	X
Hausdorff et al, 2007	0.167	X	0.174	0.371	X
McIntosh et al, 1997	X	X	0.842	0.632	X
Rochester et al, 2005	X	X	0.261	X	X
Del Olmo et al, 2006	X	X	X	X	0.167
Thaut et al, 1996	X	X	X	X	0.611
Suteerawattananon et al, 2003	X	0.24	X	X	X

Results: Stride Length

Effect Sizes of Stride Length with 95% Confidence Intervals

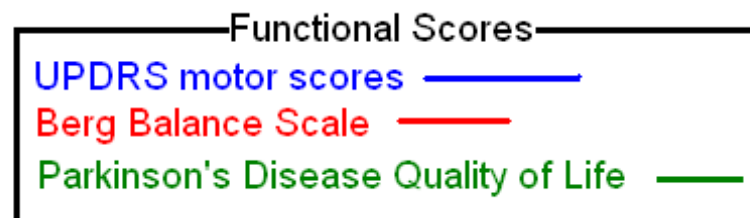
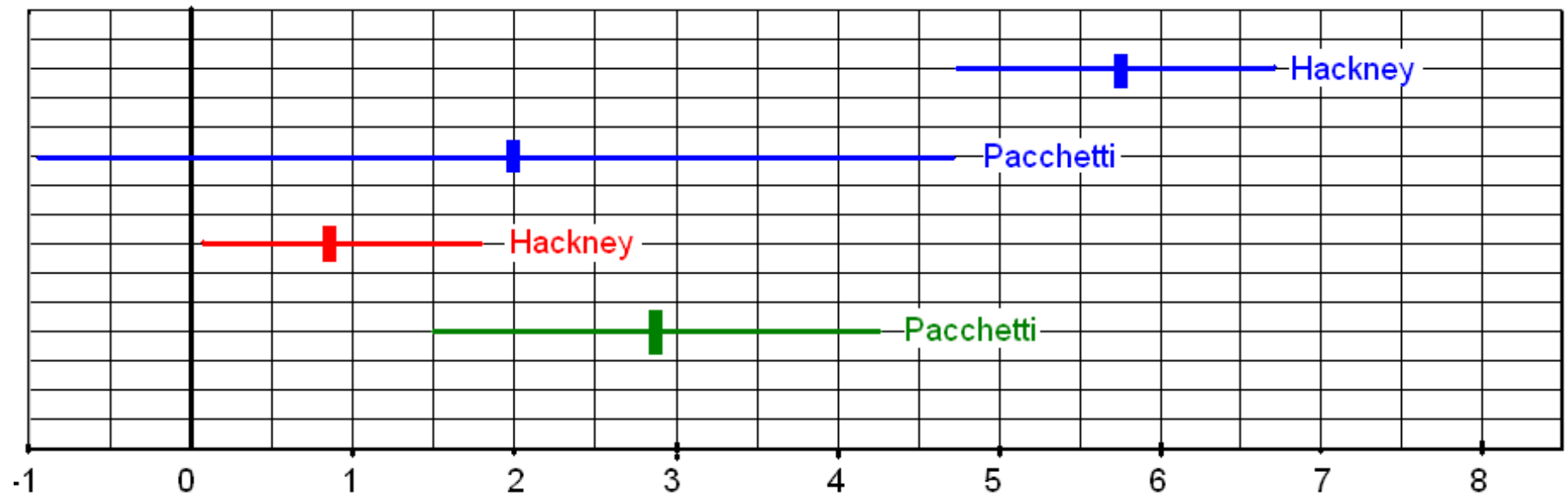


Results: Other

Author	UPDRS	Berg BS	PDQL
Hackney et al, 2007 (measured 1 week post tx)	NNT = 124 ; ES = 5.8	NNT= 23 ES =.90	X
Pacchetti et al, 2000 (measured same day as tx)	NNT = 6 ES = 1.97	X	NNT = 8 ES = 2.89

Results: Other Scores

Effect Sizes with 95% Confidence Intervals



Summary of Results

- Subjects exposed to repetitive and rhythmical stimuli or movement improved with:
 - Gait speed, Cadence and **Stride Length**
 - Balance
 - Quality of life
 - UPDRS motor score

Summary of Results

- Subjects subjectively reported enjoying the therapy with repetitive and rhythmical motions
- Long term effects
- Uncertain if rhythmical stimuli is different than standard physical therapy

Cost Effectiveness

- Addition of rhythmical stimuli does not add additional cost to physical therapy

Harm

- No reports of harm or injuries were reported in the studies.

Answered??

- This search supported the use of repetitive and rhythmical stimuli and motion :
 - Improves **stride length**, gait speed, cadence
 - Improved the UPDRS score and balance
 - Improves Parkinson's quality of life

Gap in research

- Few studies compared standard physical therapy
- Does not examine if overtime these benefits have a ceiling effect or become less effective over time
- Few studies exposed subjects to daily rhythmical stimuli

Discussion

- Fail to reject null hypothesis
 - Moderate number of studies
 - Difference between rhythmical stimuli and physical therapy
 - Some good effect sizes, but large CI's.
 - Outcomes support primarily short term effects

Discussion

- Limitations of Search
 - Only reviewed studies written in English
 - Age

Recommendations for future research

- Compare three groups
 - Music Therapy
 - Physical Therapy
 - Group exposed to both
- Develop a Home Exercise Program
 - Rhythmical Stimuli
 - Establish a daily routine
 - Monitor for 6 months to 1 year

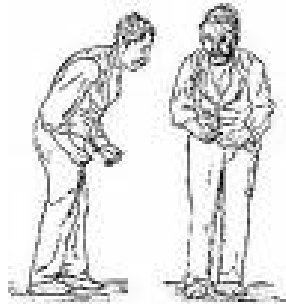
Recommendations for practice

- Include Rhythmical stimuli to exercises
 - Provide stimuli prior to exercises
 - Establish cadence 10% faster than baseline
- Encourage patients to participate in beginner dance classes
- Use of rhythmic auditory stimulation during patient's day
 - Gradually increase the tempo

Conclusions/implications for practice

- Although the evidence from this search is not conclusive, the evidence does show a trend that the use of repetitive and rhythmical stimuli and movement to music benefit patients with Parkinson's disease in terms of their gait mechanics and quality of life.

Questions and/or Comments?



Thank You

My advisor: Diane Allen, PT, PhD

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